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ABSTRACT

Some researchers have argued that it is important to match teaching styles with students' learning styles, although a relatively small amount of research has been done on learning styles in science. This study focused on the differences between male and female secondary school chemistry students in an effort to determine the relationship of gender and learning styles to achievement and laboratory skills. The sample consisted of 41 chemistry students in grades 10 and 11 in a Mississippi high school. The Canfield Learning Styles Inventory Form S-A was used to determine each student's learning style. The results of the study indicated that male chemistry students preferred situations that involved numbers and logic, computing and solving mathematical problems, and benefitted from course work that was logically and clearly organized and assignments that were meaningful. Female chemistry students tended to need laboratory activities in which they could work with people and help each other. It is suggested that the planning of different types of laboratory activities for males and females may enhance laboratory skills, and that consideration should be given to the structure of instructional procedures with females being allowed to set their own objectives and males given more logical, well-defined instructional procedures. (TW)

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The Relationship of Gender and Learning Styles to Achievement and Laboratory Skills in Secondary School Chemistry Students

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Mid-South Educational Research Association
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The importance of matching teaching styles with students' learning styles has been stressed in the literature (Dunn & Dunn, 1974, 1979). Dunn and Bruno (1986) suggest that significantly increased achievement results when teaching resources and strategies complement students' learning preferences. Contradictory and inclusive results on age, sex and intelligence as individual characteristics of learning style were reported by Rodrigue (1984). With very little work done on learning styles in the area of science, a unique opportunity to study learning styles as related to science existed with a sample of chemistry students that was largely female.

This study focused on the differences between male and female secondary school chemistry students. The purpose was to determine the relationship of gender and learning styles to achievement and laboratory skills.

Hypotheses

The following null hypotheses were tested:

1. There will be no correlation significantly different from zero between achievement in chemistry as measured by criterion-related tests and a specific preferred learning style.
2. There will be no correlation significantly different from zero between laboratory skills and a specific preferred learning style.
3. There will be no correlation significantly different from zero between achievement in chemistry as measured by criterion-related tests and any combination of learning styles.
4. There will be no correlation significantly different from zero between laboratory skills and any combination of learning styles.

Method

The sample consisted of 41 chemistry students in two intact classes in a public high school in Mississippi, 13 males and 28 females. The majority of the students were in grade 10 with the remainder in grade 11. The Canfield Learning Styles Inventory Form S-A was used to determine each student's learning style. This inventory, used with students having at least a ninth grade reading level, has the students rank in order four options that describe their preferences.

During the spring semester three laboratory experiments directly relating to textbook material being covered at the time were conducted. A 10-item checklist was devised and used by the researcher to assess each student's skill in lab. This list had a reliability of 0.99 as measured by Cronbach's alpha. Criterion-related tests were administered on each of the topics presented in laboratory and the scores recorded as a percentage of correct answers.

Data were analyzed through the use of a simple correlation to determine the correlation between achievement and specific learning styles and the correlation between lab skills and specific learning styles. A multiple regression analysis with gender forced into the prediction equation to account for differences in males and females was used to determine what combination of learning styles would serve as the best predictor of achievement and what combination would serve as the best predictor of laboratory skills.

Results

To determine what correlation, if any, would be found between each of the learning styles and achievement, a Pearson-product moment correlation was computed independently for each learning style. The results of this analysis are provided in Table 1.

Learning styles correlating significantly at the .01 level with achievement were people ($r = .44$), numeric ($r = -.44$), and goal setting ($r = .37$). Organization ($r = -.29$) correlated significantly at the .05 level.

The negative correlations for numeric and organization indicate that males work better with numbers and logic and benefit from course work that is logically and clearly organized. Females benefit from situations that are people-oriented and ones in which they set their goals and use feedback to modify procedures.

A Pearson-product moment was also computed to determine the correlation between learning styles and laboratory skills. Table 2 provides the results of this correlation.

Correlating significantly at the .01 level with lab skills was people ($r = .42$) and at the .05 level were goal setting ($r = .35$), organization ($r = -.29$), and numeric ($r = -.29$). There was also a significant correlation at the .01 level between lab skills and achievement ($r = .87$).

Negative correlations for organization and numeric indicate that males prefer lab situations that are organized and involve computing and solving mathematical problems. Females need to set their own objectives and to work with people rather than individually.

The set of predictor learning styles for achievement is shown in Table 3. The best predictor of achievement was the learning preference for working with people accounting for 21.7% of the variance. Table 4 lists the predictor set of learning styles for laboratory skills. The combination of learning styles which served as the best predictor of laboratory skills included people, accounting for 17.4% of the variance; organization, 6.1% of the variance; and peer, 8.2% of the variance.

Conclusions

These data indicate that male chemistry students prefer situations that involve numbers and logic, computing and solving mathematical problems, and benefit from course work that is logically and clearly organized and assignments that are meaningful. Female chemistry students need laboratory activities in which they can work with people and can help each other. These data suggest that the planning of different types of lab activities for males and females may enhance laboratory skills. Consideration should be given to the structure of instructional procedures with females being allowed to set their own objectives and males given more logical, well-defined instructional procedures.

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Table 1

Simple Correlations Between Achievement in Chemistry and Learning Styles

Learning Style	r
Peer	-.21
Organization	-.29*
Goal	.37**
Competition	.12
Instructor	.00
Detail	.00
Independence	.16
Authority	-.17
Numeric	-.44**
Qualitative	.09
Inanimate	.04
People	.44**
Listening	.14
Reading	-.05
Iconics	.05
Direct Experience	-.10

*p <.05, **p <.01

Table 2

Simple Correlations Between Laboratory Skills and Learning Styles

Learning Style	r
Peer	-.24
Organization	-.29*
Goal	.35*
Competition	.15
Instructor	.01
Detail	-.05
Independence	.20
Authority	-.17
Numeric	-.29*
Qualitative	-.07
Inanimate	.01
People	.42**
Listening	.05
Reading	-.01
Iconics	.09
Direct Experience	-.01

*p <.05, **p <.01

Table 3

Predictors of Chemistry Achievement for Secondary Students From Learning Styles

Learning Style	Multiple R	R square	R square added	Simple r	F to Enter	df
Gender[a]	.0426	.0018	.0018	-.04	.07	1,39
People	.4682	.2192	.2174	.44	10.58*	1,38
Total Predictor Set	.4682	.2192			5.33*	2,38

*p <.01
[a]Gender was forced into the predication equation to account for differences in males and females.

Table 4

Predictors of Laboratory Skills for Secondary Students from Learning Styles

Learning Style	Multiple R	R square	R square added	Simple r	F to Enter	df
Gender[a]	.1115	.0124	.0124	-.11	0.49	1,39
People	.4318	.1864	.1740	.42	8.13**	1,38
Organization	.4978	.2478	.0613	-.29	3.02*	1,37
Peer	.5742	.3297	.0819	-.25	4.40**	1,36
Total Predicator Set	.5742	.3297			4.43**	4,36

*p <.10, **p<.05

[a]Gender was forced into the predication equation to account for differences in males and females.